

FNAL EVM Test Bench & RCN Development

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Contents

- Status of the FNAL EVM Test Bench
 - Benchmark tests (Myrinet/Ethernet)
 - Software implementation
- Readout Control Network (RCN)
 - Requirements
 - Technology options
 - Protocol
 - Development
- Plan for Baby DAQ

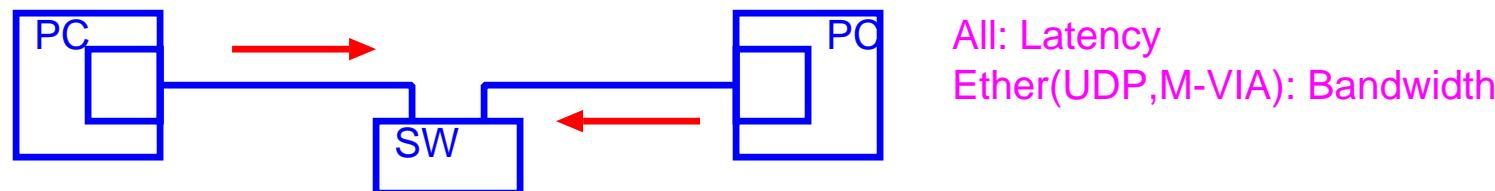
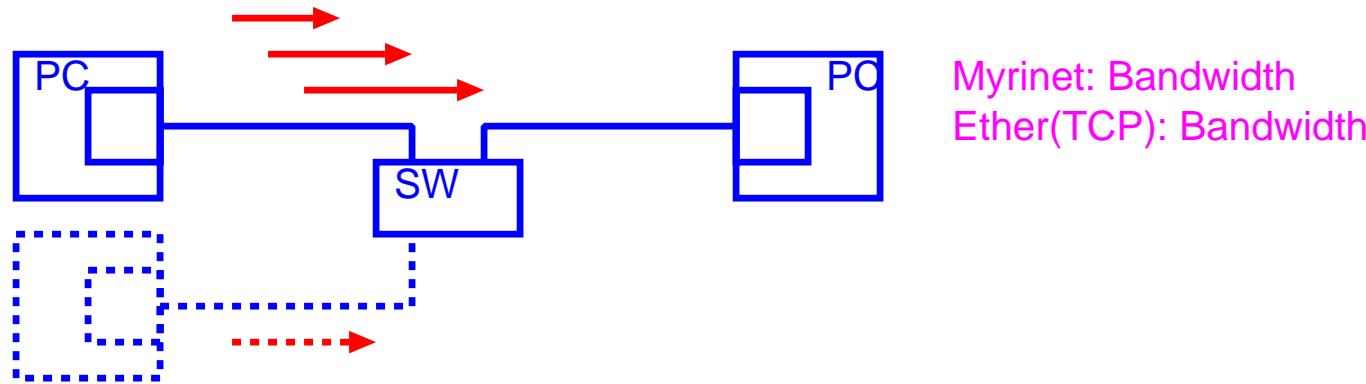
FNAL EVM Test Bench



- One Dual CPU/PCI PC and four PCs
- FastEthernet, Myrinet and IEEE1394
- One 16ports Myrinet SW and two 8ports Ethernet SWs

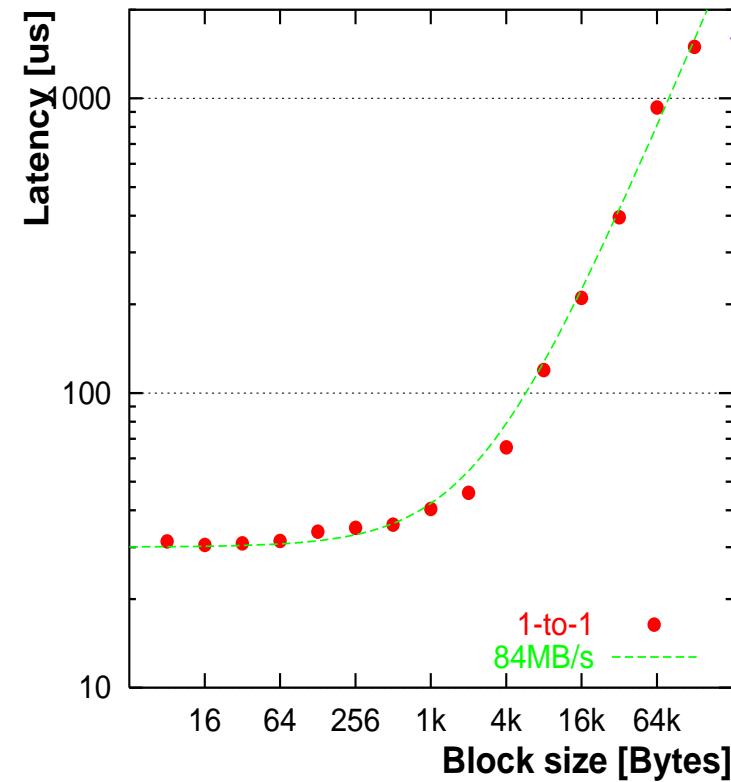
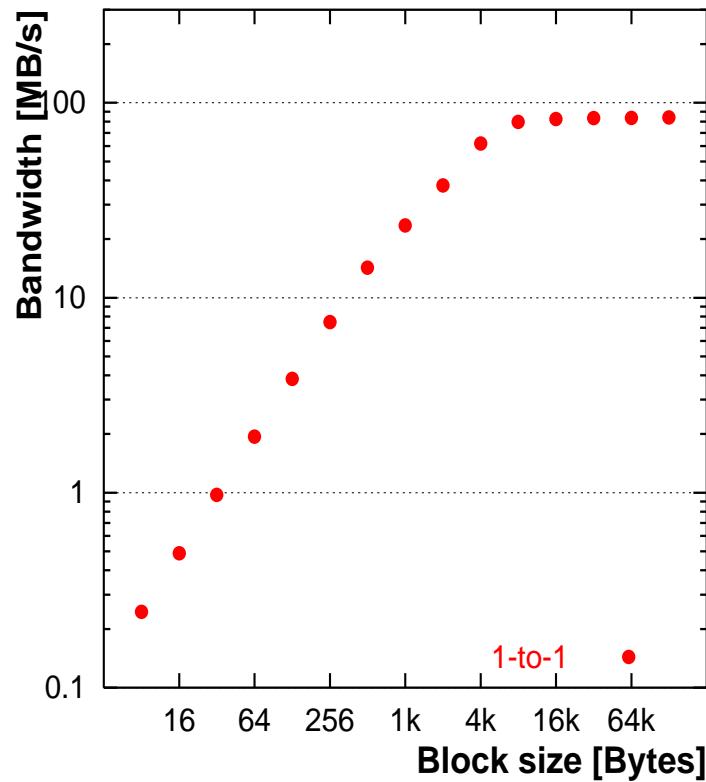
Benchmark Method

- Myrinet(GM) + Ethernet(TCP,UDP,M-VIA)
- One-way burst transfer for the Bandwidth
- Ping-Pong transfer for the Latency



Myrinet Benchmark Tests

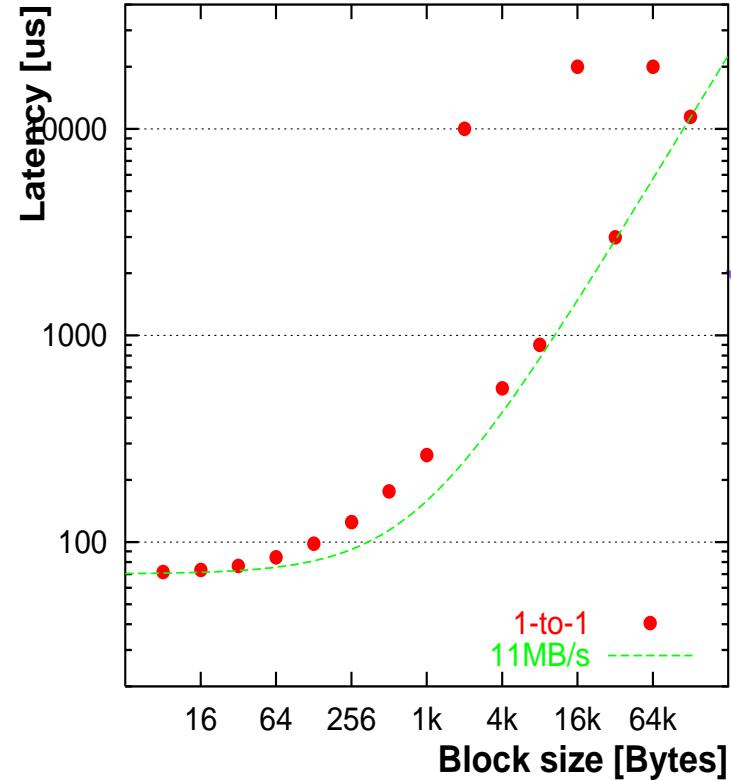
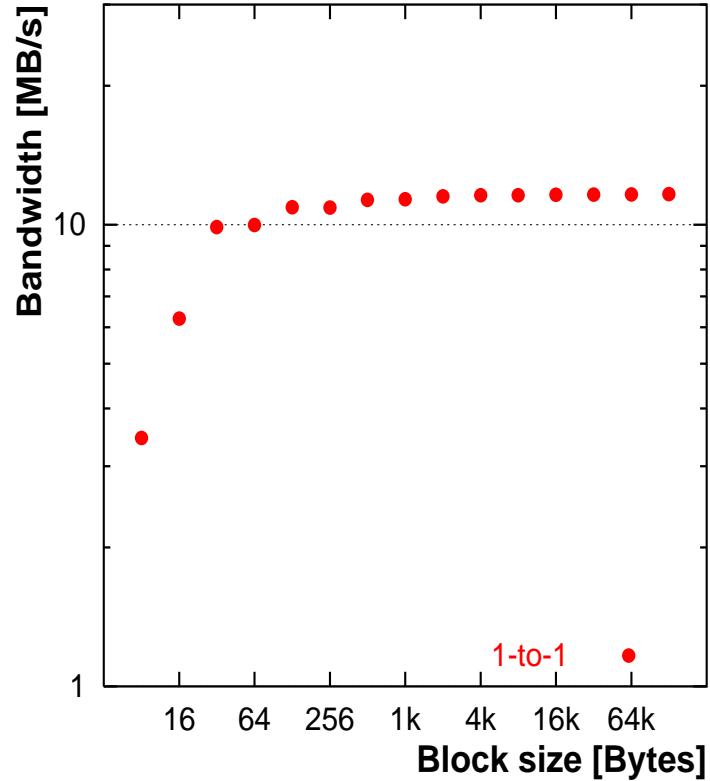
- P-II 400MHz + 32bit PCI NIC
- Linux 2.2.10 + GM 1.07



Myrinet Benchmark Tests

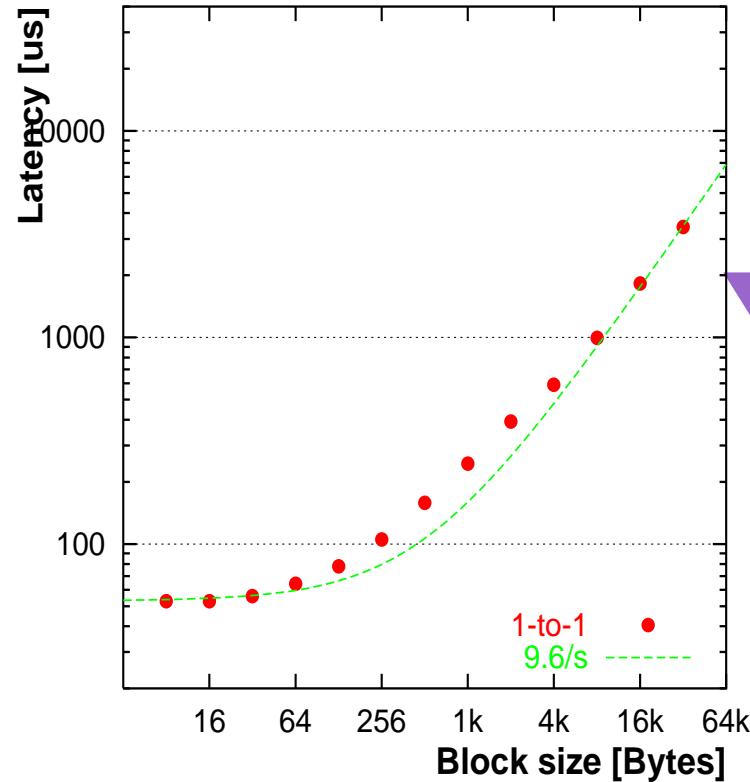
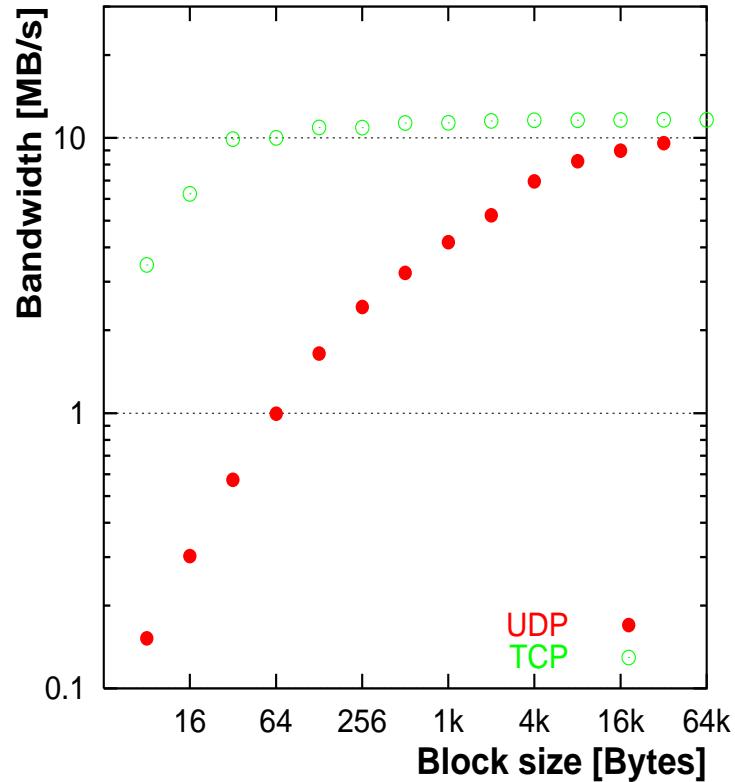
- Bandwidth: 84MB/s
- Latency: 30µs
- 58% sender BW in 2to1 connection
- No merit to use two NICs on one bus
- No difference between COMPAQ and Gateway machines
- (No conflict inside SW)

Ethernet (TCP)



- Bandwidth 11.6MB/s, Latency 72μs

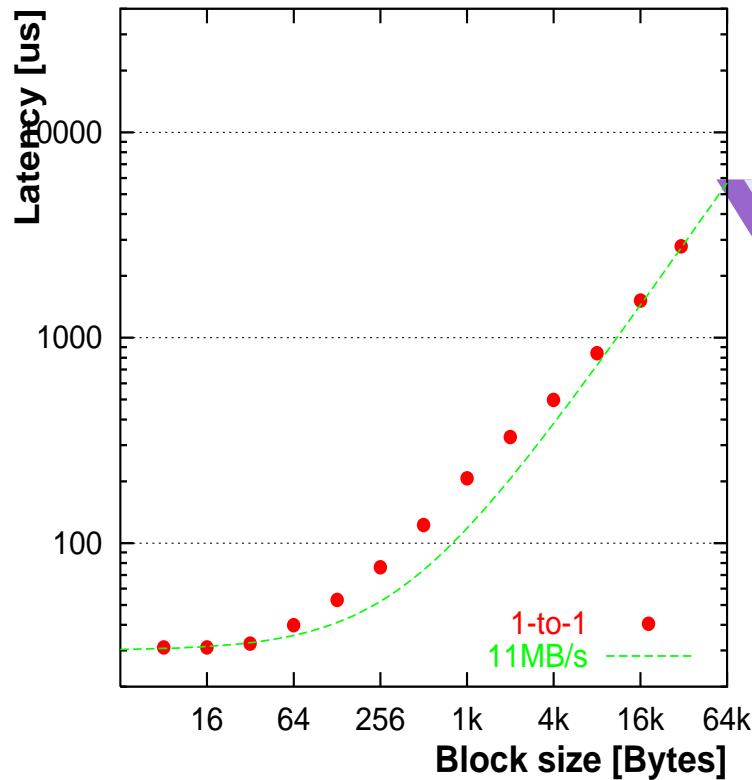
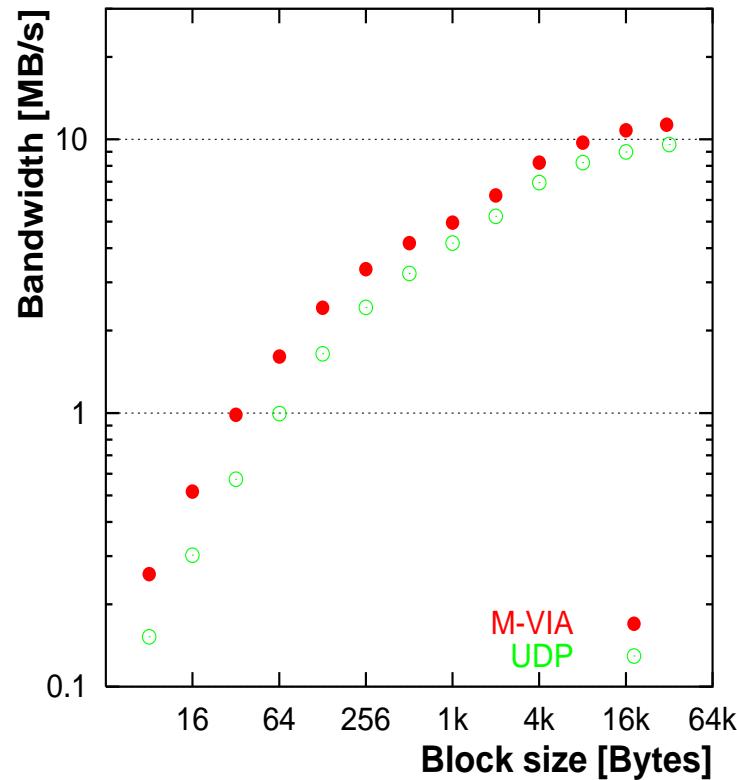
Ethernet (UDP)



- Bandwidth 9.6MB/s, Latency 53μs

Ethernet (M-VIA)

- M-VIA 0.9.3



- Bandwidth: 11.3MB/s, Latency 31μs

IEEE1394

- PCI I/F w/ TI PCI-Lynx chip
- Driver installed
 - (beta version for Linux)
- Working on test software

Software Implementation (plan)

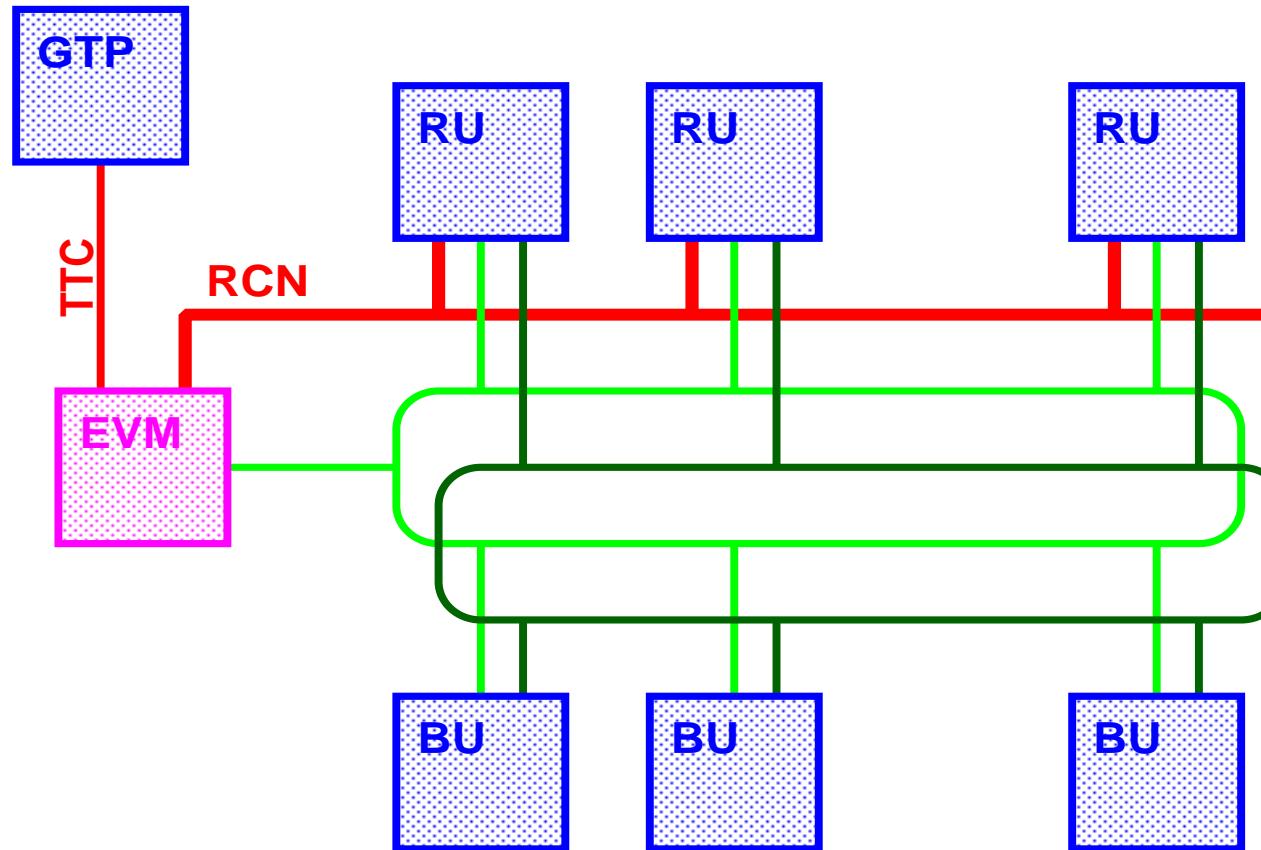
- CERN Framework for DAQ demonstrator
- Implement IoPoint of TCP and M-VIA
- Reliable UDP for RCN (another IO model???)
- Comparison to simulation

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Readout Control Network

- Distribute L1 trigger info. and Event ID
- Gather trigger throttling information



Requirements to RCN

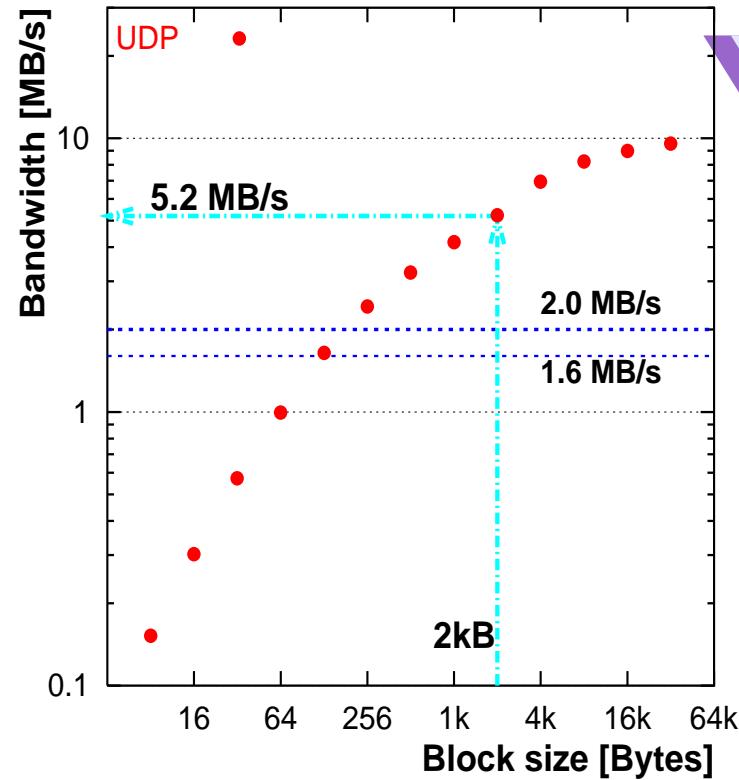
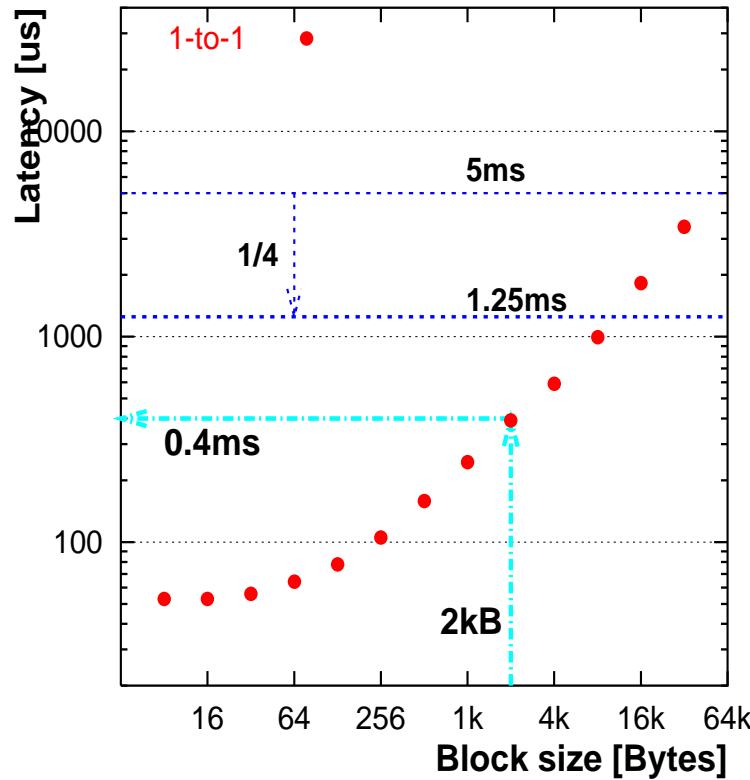
- Latency: 5ms
 - 100kHz L1
 - Fill half of 1000 events buffer in RUs/FE
- Bandwidth: $1.6\text{MB/s} + \alpha$
 - Four 32bit words / event
- Low cost
- Flexible
 - Configuration
 - Technology change

Technology Options

- FastEthernet
 - Slow, Inexpensive
 - Widely available
- Gigabit Ethernet
 - Fast, Expensive
- IEEE1394
 - Fast, Inexpensive
 - Small hardware R&D necessary

Ethernet Option

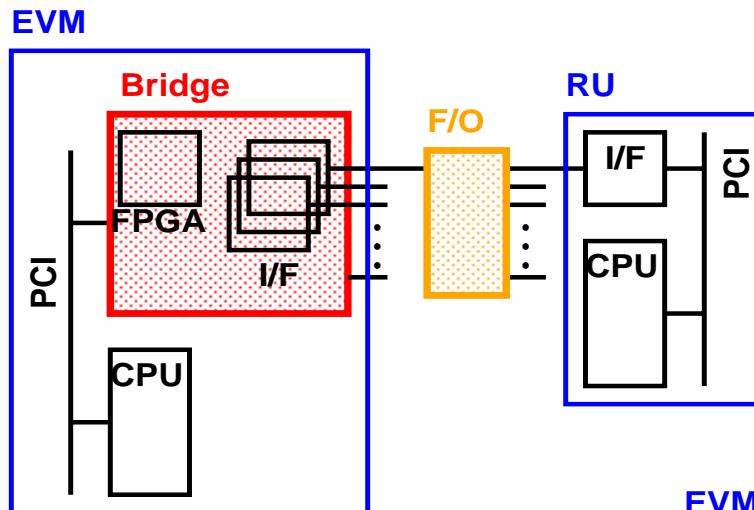
- Used in working model (baby DAQ)
- Protocol implementation + evaluation



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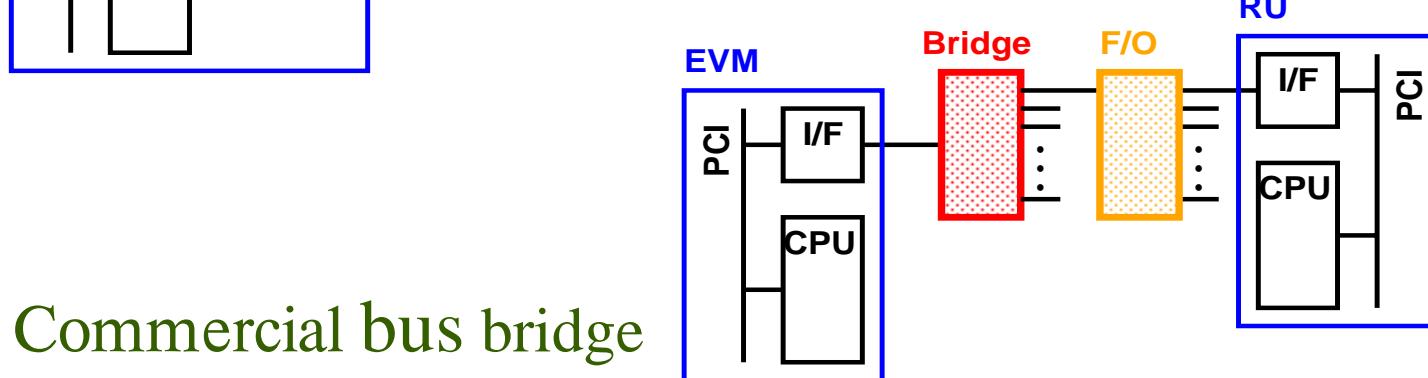
IEEE1394 Option

- # of nodes < 63 → Bus bridge



Custom bus bridge

EVM-to-RU: Broadcast
RU-to-EVM: Unicast



Commercial bus bridge

IEEE1394 Option (cont.)

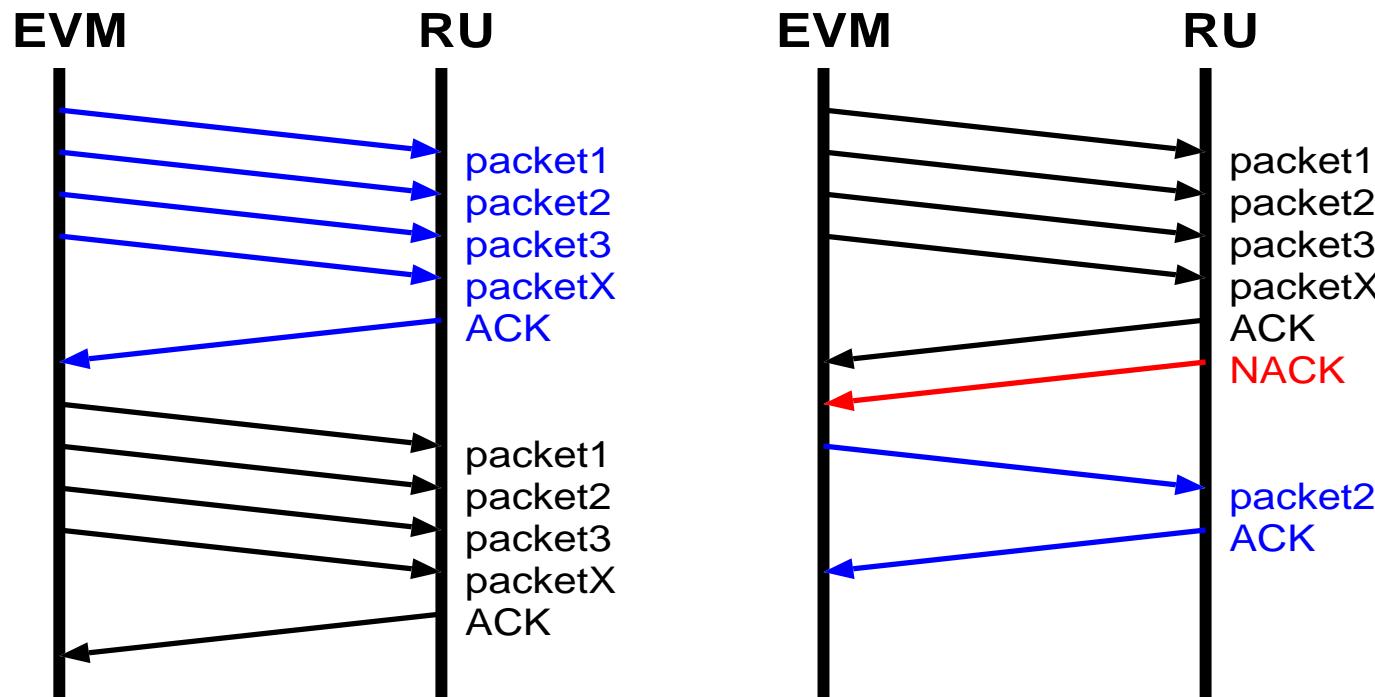
- Benchmark tests w/ PCI I/F
- Hardware development
 - Fan-out → Simple
 - Custom bus bridge
 - Two buses test model
 - Full buses model
- Quit bus bridge R&D when commercial bus bridges become available

Protocol Proposal

- Broadcast w/o flow control
- Multiple (100) events in a packet
- Error detection + repair
 - NACK-based
 - Detect data corruption by CRC
 - Detect packet loss by L1 trigger number
- Redundancy
 - e.g. 3 packets + 1 XOR (25% redundant)

Protocol Proposal (cont.)

- Congestion control
 - ACK by a few RUs to regulate the rate
 - Stop L1 when NACK implosion



Development Plan

- Test system (baby DAQ) w/ FastEthernet
- IEEE1394 Bus system development after performance measurement
- Evaluate Gigabit Ethernet system if FastEthernet performance is not enough

Open Questions

- Are RUs intelligent enough to;
 - Handle generic I/F standards?
 - Check and recover from packet loss/corruption?
- How long is the cut-through latency in FED-RU?
- Partitions??

Towards the Baby DAQ

- Software implementation: Nov. - Dec. 99
- Complete 2x2 system: end of Dec. 99
- RCN Protocol study: Jan. 00 -
- EVB Protocol study: Jan. 00 -
- IEEE1394 benchmark tests: Nov. 99
- IEEE1394 two buses bridge: Jan. - Jun. 00
- Larger configuration: ??
- EVM technical design report: ????

Summary

- FNAL EVM test bench is ready for EVM R&D
- Myrinet and Ethernet benchmark tests were done. IEEE1394 tests are going on.
- RCN hardware/software proposal (<http://home.fnal.gov/cmsevm/>)
Comments/suggestions welcome
- Construct baby DAQ in this year and EVM studies in the next year